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ENVIRONMENT CANADA
CONSERVATION AND PROTECTION
ENVIRONMENTAL PROTECTION
PACIFIC AND YUKON REGION

BENTHIC SEDIMENT CHEMISTRY
BRITISH COLUMBIA OCEAN DUMPSITES
OCTOBER 1988

REGIONAL DATA REPORT DR-90-07

by

D.E. Brothers

June 1990

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1.0 Introduction

In October 1988, a benthic sediment chemistry survey was conducted at the Point Grey, Sand Heads and Victoria dumpsites using the survey vessel CSS Vector. The data collected is part of a routine monitoring and assessment program of ocean dumpsite locations by Conservation and Protection. At each major ocean dumpsite, a monitoring grid has been established to facilitate sucessive surveys. (Figure 1, 2 and 3).

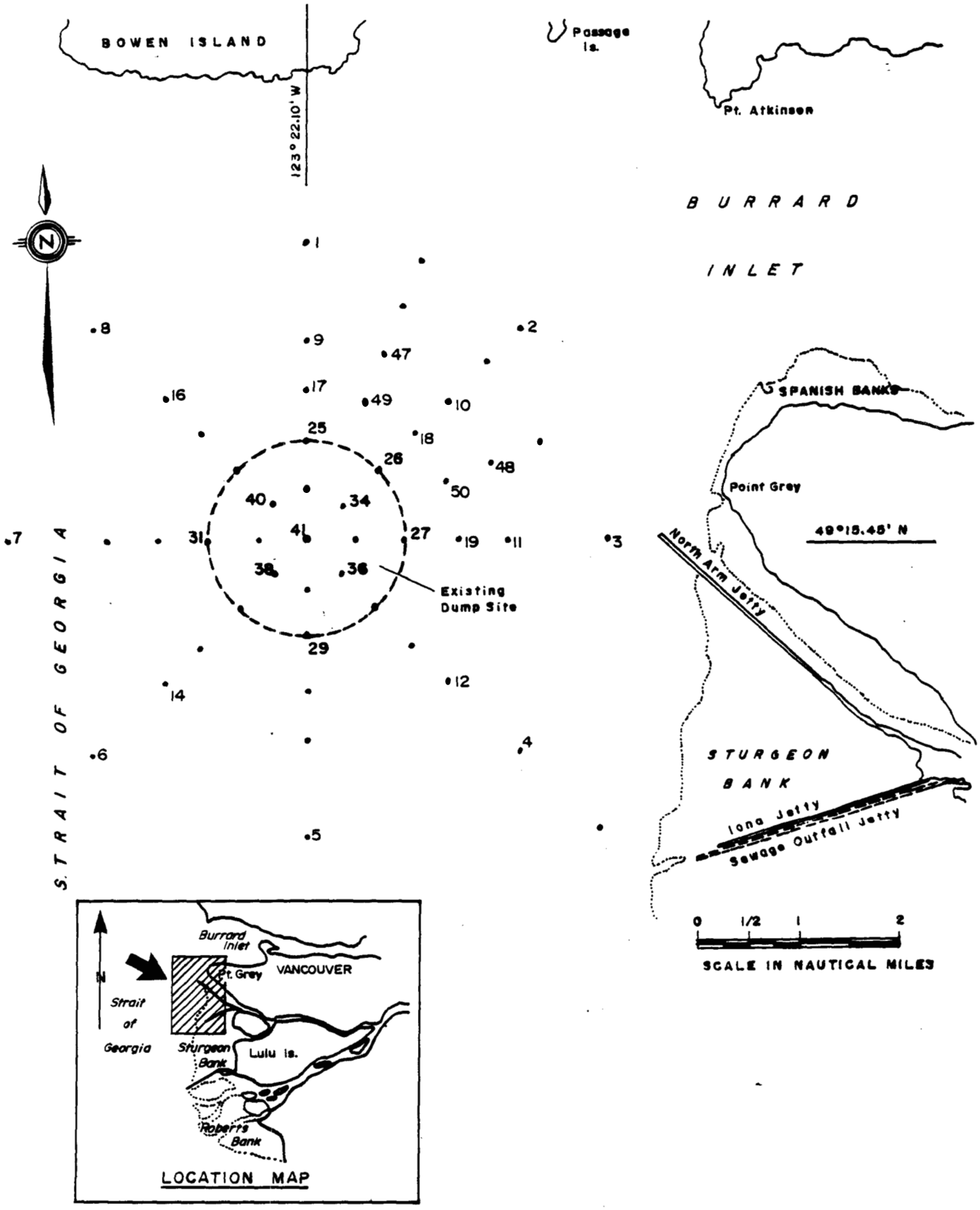

FIGURE I POINT GREY OCEAN DUMPSITE - BENTHIC SEDIMENT SAMPLING STATIONS

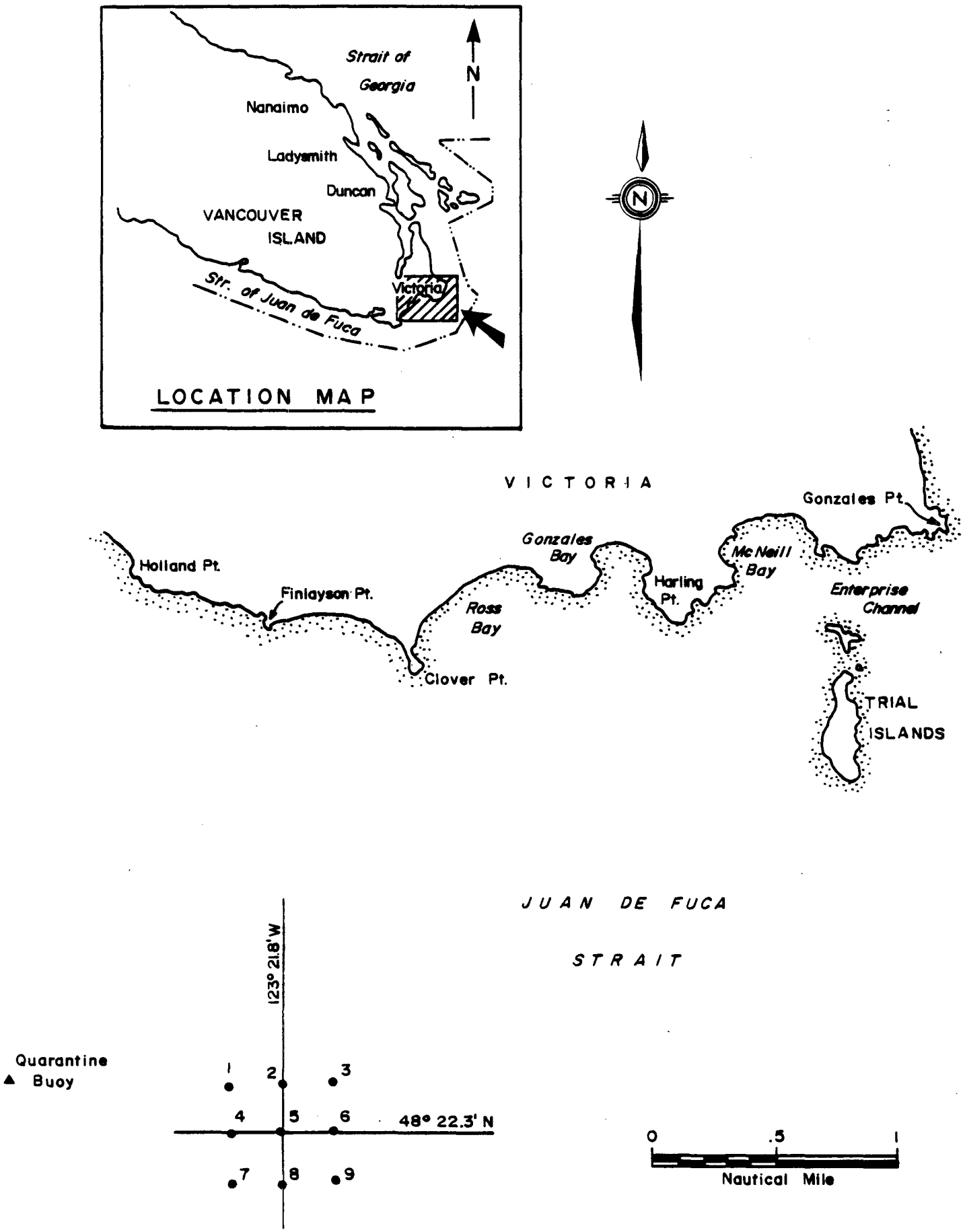

FIGURE 2 VICTORIA OCEAN DUMPSITE - BENTHIC SEDIMENT SAMPLING STATIONS

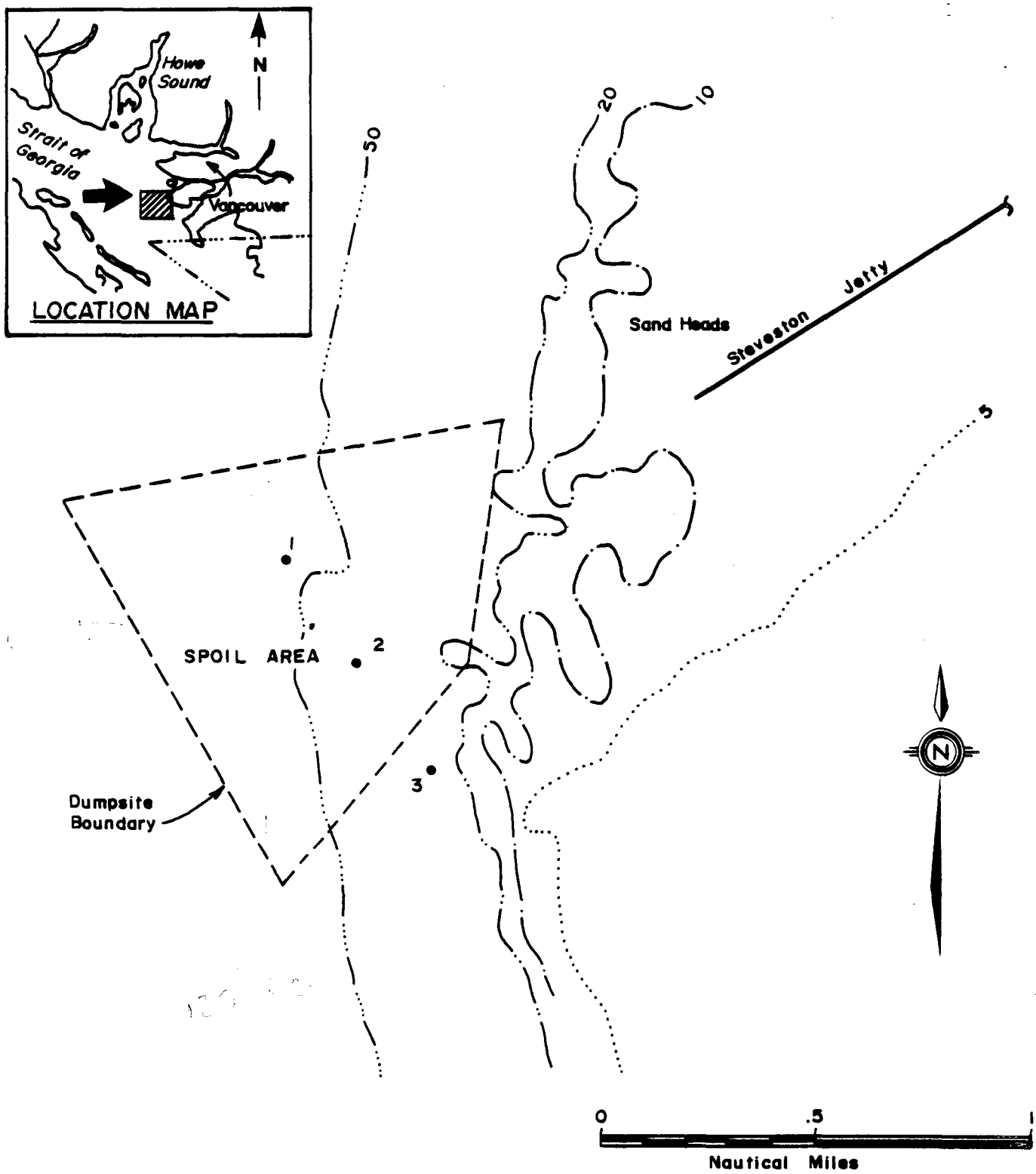

FIGURE 3 SAND HEADS OCEAN DUMPSITE - BENTHIC SEDIMENT SAMPLING STATIONS

2.0 Material and Methods

Grab samples were taken using a Smith McIntyre sampler. One grab was taken at each station. Upon retrieval, water was siphoned from the surface sediment, if necessary. Three samples, 0 to 5 cm sediment depth, were taken from each grab.

Cadmium, mercury, lead, copper and zinc concentrations are presented in the tables, along with the mean and standard deviation.

All analyses were conducted by the Conservation and Protection Laboratories in West Vancouver. The raw data represents a single analysis for each sample after drying and homogenizing. Cu, Pb, and Zn were analysed using Inductively Coupled Argon Plasma Atomic Emission (ICAP-AE), Cd using Graphite Furnace Atomic Absorption (GFAA), and Hg using flameless AA.

The accuracy data for each lab submission are given in Appendix I. The raw data printout, giving the complete ICAP semi-quantitative scan and particle size data, are included in Appendix II, and can be located by matching the sample and lab submission numbers given on the data tables. Precision data for the lab submissions are provided on the data tables, and represent analyses of separate aliquots of dryed, homogenized sediments from the sample bag.

TABLE 1

POINT GREY DUMPSITE - STATIONS 1-50

METALS LAB # 880797

DATE SAMPLED: OCTOBER 17, 1988. PARTICLE SIZE LAB # 880797

STN	DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	Hg (UG/G DRY WEIGHT)	Cd	Pb	Cu	Zn
1	235	1*	0-5	.120	.37	18.0	50.2	116.0
		2	0-5	.110	.25	17.0	49.8	138.0
		3	0-5	.100	.28	20.0	50.0	125.0
			MEAN	.110	.30	18.3	50.0	126.3
			STD DEV	.010	.06	1.5	.2	11.1
2	115	22*	0-5	.096	.18	30.0	54.9	111.0
		23	0-5	.098	.20	25.0	57.7	117.0
		24	0-5	.100	.30	19.0	57.3	132.0
			MEAN	.098	.23	24.7	56.6	120.0
			STD DEV	.002	.06	5.5	1.5	10.8
3	54	19*	0-5	.040	.10	ND(8)	23.6	61.1
		20	0-5	.470	.19	48.0	28.9	64.9
		21	0-5	.044	.10	9.0	24.2	63.2
			MEAN	.185	.13		25.6	63.1
			STD DEV	.247	.05		2.9	1.9
4	140	16*	0-5	.088	.24	10.0	45.4	117.0
		17	0-5	.089	.26	20.0	46.2	122.0
		18	0-5	.084	.33	16.0	44.1	119.0
			MEAN	.087	.28	15.3	45.2	119.3
			STD DEV	.003	.05	5.0	1.1	2.5
5	228	13*	0-5	.085	.36	10.0	41.7	108.0
		14	0-5	.082	.25	16.0	42.3	106.0
		15	0-5	.082	.22	10.0	43.2	108.0
			MEAN	.083	.28	12.0	42.4	107.3
			STD DEV	.002	.07	3.5	.8	1.2
6	291	10*	0-5	.091	.55	17.0	45.5	107.0
		11	0-5	.088	.29	20.0	43.3	108.0
		12	0-5	.087	.21	10.0	43.9	107.0
			MEAN	.089	.35	15.7	44.2	107.3
			STD DEV	.002	.18	5.1	1.1	.6
7	237	7*	0-5	.110	.28	18.0	48.9	137.0
		8	0-5	.100	.22	18.0	48.8	136.0
		9	0-5	.100	.38	16.0	50.0	131.0
			MEAN	.103	.29	17.3	49.2	134.7
			STD DEV	.006	.08	1.2	.7	3.2

NOTE: numbers in brackets are limits of detection. (cf:SCPPGRY)
ND - not detected
* denotes particle size data in appendix.

POINT GREY DUMPSITE - STATIONS 1-50 (cont'd)

METALS LAB # 880797
DATE SAMPLED: OCTOBER 17, 1988. PARTICLE SIZE LAB # 880797

STN	DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)		UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
8	173	4*	0-5		.120	.26	21.0	58.3	143.0
		5	0-5		.120	.25	19.0	58.1	154.0
		6	0-5		.120	.24	25.0	58.7	138.0
				MEAN	.120	.25	21.7	58.4	145.0
				STD DEV	.000	.01	3.1	.3	8.2
9	241	25*	0-5		.090	.28	17.0	46.4	112.0
		26	0-5		.110	.24	32.0	49.3	131.0
		27	0-5		.096	.37	22.0	47.6	114.0
				MEAN	.099	.30	23.7	47.8	119.0
				STD DEV	.010	.07	7.6	1.5	10.4
10	150	46*	0-5		.090	.95	19.0	48.8	110.0
		47	0-5		.100	.22	20.0	48.0	114.0
		48	0-5		.100	.21	18.0	46.4	93.6
				MEAN	.097	.46	19.0	47.7	105.9
				STD DEV	.006	.42	1.0	1.2	10.8
11	155	40*	0-5		.087	.21	20.0	47.5	123.0
		41	0-5		.092	.22	20.0	45.3	144.0
		42	0-5		.091	.20	17.0	47.7	135.0
				MEAN	.090	.21	19.0	46.8	134.0
				STD DEV	.003	.01	1.7	1.3	10.5
12	200	37*	0-5		.090	.23	17.0	44.2	112.0
		38	0-5		.092	.27	20.0	43.6	125.0
		39	0-5		.087	.24	16.0	44.6	111.0
				MEAN	.090	.25	17.7	44.1	116.0
				STD DEV	.003	.02	2.1	.5	7.8
14	264	34	0-5		.090	.18	18.0	42.6	122.0
		35	0-5		.090	.20	21.0	42.5	116.0
		36	0-5		.110	.23	23.0	43.3	136.0
				MEAN	.097	.20	20.7	42.8	124.7
				STD DEV	.012	.03	2.5	.4	10.3
16	210	28*	0-5		.130	.25	21.0	55.8	126.0
		29	0-5		.110	.22	26.0	54.1	134.0
		30	0-5		.130	.24	26.0	54.8	139.0
				MEAN	.123	.24	24.3	54.9	133.0
				STD DEV	.012	.02	2.9	.9	6.6

NOTE: numbers in brackets are limits of detection. (cf:SCPPGRY)
ND - not detected
* denotes particle size data in appendix.

POINT GREY DUMPSITE - STATIONS 1-50 (cont'd)

DATE SAMPLED: OCTOBER 17, 1988.

METALS LAB # 880797
PARTICLE SIZE LAB # 880797

STN	DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)		UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
17	243	52*	0-5		.082	.23	18.0	43.6	99.8
		53	0-5		.088	.20	20.0	42.2	103.0
		54	0-5		.080	.24	17.0	43.3	111.0
				MEAN	.083	.22	18.3	43.0	104.6
				STD DEV	.004	.02	1.5	.7	5.8
18	193	70*	0-5		.062	.09	10.0	38.7	89.9
		71	0-5		.066	.20	10.0	37.4	101.0
		72	0-5		.060	.31	10.0	34.9	94.0
				MEAN	.063	.20	10.0	37.0	95.0
				STD DEV	.003	.11	.0	1.9	5.6
19	200	64*	0-5		.062	.17	10.0	35.8	85.6
		65	0-5		.070	.17	10.0	39.3	101.0
		66	0-5		.082	.21	10.0	41.9	101.0
				MEAN	.071	.18	10.0	39.0	95.9
				STD DEV	.010	.02	.0	3.1	8.9
25	246	76*	0-5		.070	.48	20.0	68.9	99.1
		77	0-5		.058	.93	20.0	94.8	95.6
		78	0-5		.074	.25	10.0	42.9	102.0
				MEAN	.067	.55	16.7	68.9	98.9
				STD DEV	.008	.35	5.8	26.0	3.2
26	233	88*	0-5		.050	.10	ND(8)	28.5	77.1
		89	0-5		.060	.10	ND(8)	34.8	82.9
		90	0-5		.055	.16	ND(8)	32.9	98.9
				MEAN	.055	.12		32.1	86.3
				STD DEV	.005	.03		3.2	11.3
27	217	85*	0-5		.056	.10	ND(8)	26.7	65.4
		86	0-5		.044	.03	ND(8)	25.4	68.6
		87	0-5		.039	.02	ND(8)	26.9	69.3
				MEAN	.046	.05		26.3	67.8
				STD DEV	.009	.04		.8	2.1
29	236	61*	0-5		.073	.17	10.0	38.7	94.0
		62	0-5		.087	.20	10.0	40.6	114.0
		63	0-5		.080	.10	9.0	40.8	108.0
				MEAN	.080	.16	9.7	40.0	105.3
				STD DEV	.007	.05	.6	1.2	10.3

NOTE: numbers in brackets are limits of detection. (cf:SCPPGRY)
ND - not detected
* denotes particle size data in appendix.

POINT GREY DUMPSITE - STATIONS 1-50 (cont'd)

METALS LAB # 880797
DATE SAMPLED: OCTOBER 17, 1988. PARTICLE SIZE LAB # 880797

STN	DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)		UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
31	236	31*	0-5		.086	.10	23.0	41.0	102.0
		32	0-5		.083	.18	25.0	42.2	106.0
		33	0-5		.091	.10	26.0	44.2	123.0
				MEAN	.087	.13	24.7	42.5	110.3
				STD DEV	.004	.05	1.5	1.6	11.2
34	242	91*	0-5		.066	.10	ND(8)	28.5	65.0
		92	0-5		.043	.10	ND(8)	26.8	68.9
		93	0-5		.062	.10	ND(8)	29.5	74.7
				MEAN	.057	.10		28.3	69.5
				STD DEV	.012	.00		1.4	4.9
36	240	82*	0-5		.042	.09	ND(8)	28.0	65.5
		83	0-5		.037	.08	ND(8)	30.0	69.2
		84	0-5		.049	.10	ND(8)	26.1	68.1
				MEAN	.043	.09		28.0	67.6
				STD DEV	.006	.01		2.0	1.9
38	243	58*	0-5		.057	.10	10.0	35.1	78.5
		59	0-5		.059	.10	10.0	33.6	85.6
		60	0-5		.062	.10	ND(8)	37.9	87.4
				MEAN	.059	.10		35.5	83.8
				STD DEV	.003	.00		2.2	4.7
40	236	55*	0-5		.069	1.88	10.0	38.6	94.0
		56	0-5		.076	2.29	10.0	38.7	107.0
		57	0-5		.072	1.60	10.0	36.2	86.6
				MEAN	.072	1.92	10.0	37.8	95.9
				STD DEV	.004	.35	.0	1.4	10.3
41	244	79*	0-5		.041	.09	ND(8)	26.9	61.2
		80	0-5		.042	.10	ND(8)	28.4	70.5
		81	0-5		.049	.10	ND(8)	30.4	69.3
				MEAN	.044	.10		28.6	67.0
				STD DEV	.004	.01		1.8	5.1
47	168	49*	0-5		.087	.23	21.0	47.6	107.0
		50	0-5		.100	.22	19.0	48.0	113.0
		51	0-5		.093	.21	20.0	46.9	117.0
				MEAN	.093	.22	20.0	47.5	112.3
				STD DEV	.007	.01	1.0	.6	5.0

NOTE: numbers in brackets are limits of detection. (cf:SCPPGRY)
ND - not detected
* denotes particle size data in appendix.

POINT GREY DUMPSITE - STATIONS 1-50 (cont'd)

METALS LAB # 880797
DATE SAMPLED: OCTOBER 17, 1988. PARTICLE SIZE LAB # 880797

STN	DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
48	128	43*	0-5	.083	.24	10.0	46.1	109.0
		44	0-5	.088	.17	20.0	46.5	110.0
		45	0-5	.077	.17	10.0	45.3	101.0
			MEAN	.083	.19	13.3	46.0	106.7
			STD DEV	.006	.04	5.8	.6	4.9
49	232	73*	0-5	.070	.10	20.0	41.5	98.2
		74	0-5	.062	.10	10.0	37.5	102.0
		75	0-5	.061	.22	17.0	39.3	81.6
			MEAN	.064	.14	15.7	39.4	93.9
			STD DEV	.005	.07	5.1	2.0	10.8
50	192	67*	0-5	.065	.20	ND(8)	35.8	88.8
		68	0-5	.093	.20	9.0	36.2	91.7
		69	0-5	.068	.06	10.0	36.1	94.1
			MEAN	.075	.15		36.0	91.5
			STD DEV	.015	.08		.2	2.7

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
20	.470	.19	48.0	28.9	64.9
130	.044	.26	ND(8)	23.8	62.9
131	.040	.10	ND(8)	24.5	61.9
132	.043	.23	10.0	24.4	61.5
133	.039	.20	ND(8)	24.0	61.3
MEAN	.127	.20		25.1	62.5
STD DEV	.192	.06		2.1	1.5
40	.087	.21	20.0	47.5	123.0
134	.078	.08	10.0	47.1	123.0
135	.089	.09	10.0	47.5	124.0
136	.079	.09	20.0	47.4	122.0
137	.080	.09	10.0	47.0	121.0
MEAN	.083	.11	14.0	47.3	122.6
STD DEV	.005	.05	5.5	.2	1.1
60	.062	.10	ND(8)	37.9	87.4
138	.058	.06	8.0	34.4	85.3
139	.058	.06	10.0	34.3	86.3
140	.054	.05	9.0	34.6	84.8
141	.055	.10	ND(8)	36.2	84.6
MEAN	.057	.07		35.5	85.7
STD DEV	.003	.02		1.6	1.2
80	.042	.10	ND(8)	28.4	70.5
142	.045	.17	ND(8)	25.8	68.9
143	.042	.20	ND(8)	28.5	73.7
144	.042	.17	ND(8)	27.2	68.1
145	.039	.10	ND(8)	25.0	65.5
MEAN	.042	.15		27.0	69.3
STD DEV	.002	.05		1.6	3.0

NOTE: numbers in brackets are limits of detection.
ND - not detected (cf:SCPPGRY)
* denotes particle size data in appendix.

TABLE 2

VICTORIA DUMPSITE - STATIONS 1-9

METALS LAB # 880797

DATE SAMPLED: OCTOBER 19, 1988. PARTICLE SIZE LAB # 880797

STN	DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
1	93	103*	0-5	.032	.20	ND(8)	15.0	44.1
		104	0-5	.061	.08	ND(8)	23.9	45.8
		105	0-5	.032	.10	ND(8)	17.6	51.6
			MEAN	.042	.13		18.8	47.2
			STD DEV	.017	.06		4.6	3.9
2	98	106*	0-5	.020	.10	ND(8)	10.0	36.1
		107	0-5	.048	.10	ND(8)	9.1	33.7
		108	0-5	.018	.19	ND(8)	11.0	34.5
			MEAN	.029	.13		10.0	34.8
			STD DEV	.017	.05		1.0	1.2
3	100	109*	0-5	.010	.10	120	11.0	29.0
		110	0-5	.020	.10	ND(8)	13.0	32.7
		111	0-5	.019	.10	ND(8)	11.0	29.1
			MEAN	.016	.10		11.7	30.3
			STD DEV	.006	.00		1.2	2.1
4	100	118*	0-5	.026	.20	20	17.0	41.9
		119	0-5	.026	.17	ND(8)	21.3	50.0
		120	0-5	.039	.18	ND(8)	15.0	41.2
			MEAN	.030	.18		17.8	44.4
			STD DEV	.008	.02		3.2	4.9
5	100	115*	0-5	.024	.10	ND(8)	16.3	41.6
		116	0-5	.021	.16	10	20.1	47.2
		117	0-5	.022	.18	ND(8)	14.0	41.2
			MEAN	.022	.15		16.8	43.3
			STD DEV	.002	.04		3.1	3.4
6	100	112*	0-5	.010	.17	ND(8)	14.0	45.4
		113	0-5	.010	.18	ND(8)	14.0	32.5
		114	0-5	.010	.16	ND(8)	8.5	28.6
			MEAN	.010	.17		12.2	35.5
			STD DEV	.000	.01		3.2	8.8
7	100	121*	0-5	.020	.20	ND(8)	11.0	32.7
		122	0-5	.026	.20	ND(8)	13.0	39.6
		123	0-5	.010	.18	ND(8)	10.0	37.2
			MEAN	.019	.19		11.3	36.5
			STD DEV	.008	.01		1.5	3.5

NOTE: numbers in brackets are limits of detection. (cf:SCPVICTO)
ND - not detected
* denotes particle size data in appendix.

VICTORIA DUMPSITE - STATIONS 1-9 (cont'd)

DATE SAMPLED: OCTOBER 19, 1988.

METALS LAB # 880797
PARTICLE SIZE LAB # 880797

STN	DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
8	100	124*	0-5	.017	.17	10	11.0	37.7
		125	0-5	.020	.10	ND(8)	11.0	38.1
		126	0-5	1.540	.10	ND(8)	14.0	43.0
			MEAN	.526	.12		12.0	39.6
			STD DEV	.878	.04		1.7	3.0
9	100	127*	0-5	.018	.10	ND(8)	13.0	39.1
		128	0-5	.010	.10	ND(8)	19.0	74.9
		129	0-5	.020	.10	ND(8)	12.0	35.3
			MEAN	.016	.10		14.7	49.8
			STD DEV	.005	.00		3.8	21.8

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
120	.039	.18	ND(8)	15.0	41.2
150	.024	.10	ND(8)	15.0	39.4
151	.024	.10	ND(8)	17.4	40.9
152	.023	.10	ND(8)	15.9	40.0
153	.027	.10	ND(8)	19.7	41.4
MEAN	.027	.12		16.6	40.6
STD DEV	.007	.04		2.0	.8

NOTE: numbers in brackets are limits of detection. (cf:SCPVICTO)
ND - not detected
* denotes particle size data in appendix.

TABLE 3

SAND HEADS DUMPSITE - STATIONS 1-3

METALS LAB # 88079

DATE SAMPLED: OCTOBER 18, 1988. PARTICLE SIZE LAB # 88079

STN	DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	Hg	Cd	Pb	Cu	Zn
				UG/G DRY WEIGHT				
SH-1	100	94*	0-5	.041	.10	ND(8)	28.0	58.1
		95	0-5	.047	.10	ND(8)	29.4	68.8
		96	0-5	.047	.10	ND(8)	32.1	71.0
			MEAN	.045	.10		29.8	66.0
			STD DEV	.003	.00		2.1	6.9
SH-2	70	97*	0-5	.060	.10	ND(8)	26.6	60.0
		98	0-5	.041	.20	ND(8)	31.9	70.9
		99	0-5	.038	.10	ND(8)	29.0	64.8
			MEAN	.046	.13		29.2	65.2
			STD DEV	.012	.06		2.7	5.5
SH-3	44	100*	0-5	.035	.10	ND(8)	34.7	67.1
		101	0-5	.043	.10	ND(8)	28.6	62.9
		102	0-5	.037	.10	ND(8)	29.9	63.0
			MEAN	.038	.10		31.1	64.3
			STD DEV	.004	.00		3.2	2.4

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
100	.035	.10	ND(8)	34.7	67.1
146	.032	.10	ND(8)	34.0	65.8
147	.031	.16	ND(8)	34.5	71.8
148	.037	.19	ND(8)	35.4	68.5
149	.042	.17	ND(8)	34.9	67.1
MEAN	.035	.14		34.7	68.1
STD DEV	.004	.04		.5	2.3

NOTE: numbers in brackets are limits of detection. (cf:SCPSANDH)
ND - not detected
* denotes particle size data in appendix.

APPENDIX I

ACCURACY DATA

ACCURACY DATA

LAB #880797

	Hg	Cd	Pb	Cu	Zn
MESS-1					
CERTIFIED:	0.171 +/- 0.014	0.59 +/- 0.10	34.0 +/- 6.1	25.1 +/- 3.8	181 +/- 17
FOUND:	.184	.77	28	23.7	168.0
	.192	.72	28	26.7	173.0
	.213	.76	27	24.5	169.0
	.200	1.10	27	24.3	170.0
	.202	.80	28	24.1	172.0
MEAN	.198	.83	28	24.7	170.4
STD DEV	.011	.15	1	1.2	2.1
BCSS-1					
CERTIFIED:	0.129 +/- .012	0.25 +/- .04	22.7 +/- 3.4	18.5 +/- 2.7	119 +/- 12
FOUND:	.150	.52	22	16.0	126.0
	.140	.27	20	16.0	94.7
	.150	.21	17	16.5	96.3
	.140	.24	22	16.3	95.2
	.140	.21	20	17.0	99.1
MEAN	.144	.29	20	16.4	101.5
STD DEV	.005	.13	2	.4	14.3

(cf:AC880797)

NOTE: Numbers in brackets are limits of detection.
ND - not detected

APPENDIX II

RAW DATA AND PARTICLE SIZE
DISTRIBUTION: BENTHIC SEDIMENT
SAMPLING: OCTOBER 1988